

# BUILDING COMMISSIONING

## for better public buildings

### CASE STUDY

#### NORTH THURSTON HIGH SCHOOL — ADDRESSING INDOOR AIR QUALITY ISSUES



*North Thurston High School*

A project to address indoor air quality (IAQ) issues at the 19-year-old facility began in early 2000. The school district was also concerned that energy consumption had increased significantly in 1999 compared to the previous two years, and that other operational issues were developing in the heating, ventilating, and air conditioning (HVAC) system.

The school district, in conjunction with the Washington State Department of General Administration's building commissioning program, hired Keithly Welsh Associates as the commissioning agent. In Phase 1 of the project, Keithly Welsh retro-commissioned the existing HVAC system. In Phase 2 (construction), Keithly Welsh commissioned repairs and replacements to the HVAC system.

#### COMMISSIONING QUICK FACTS

Building Name	North Thurston High School
Location	Lacey, Washington
Project	Repair/replace HVAC components to address indoor air quality concerns
Commissioning Scope	Evaluation of existing HVAC (Phase 1—retro-commissioning), followed by commissioning of new HVAC components (Phase 2—construction)
Building Size	170,000 sq.ft.
Total Construction Cost	\$1,027,260
Total Commissioning Cost	\$42,180
Commissioning as % of Construction Cost	1.9% (Phase 2)
Commissioning Cost per Square Foot	\$0.25 (Phase 2)
First-Year Cost Benefit	\$31,600
Annual Energy Savings	\$24,300 per year

## PROJECT PARTNERS

**Washington State  
Department of General  
Administration**  
Roger Wigfield

**North Thurston School  
District**  
Dean Martinolich

**Keithly Welsh Associates**  
(Commissioning Agent)  
Bryan Welsh

**Hultz/BHU**  
(Design Engineers—Prime)  
Ted Veach

**Capital Plumbing & Heating**  
(General/Mechanical  
Contractor)  
Dennis Rech

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"[During construction, commissioning] caught a number of airflow issues that would have gone unnoticed by the occupants; e.g., noise level and sufficient outside air quantities."

Dean Martinolich  
North Thurston Public Schools

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## PROJECT SCOPE OF WORK

In Phase 1 (retro-commissioning) the commissioning agent evaluated operation of existing HVAC system components, recommending long- and short-term improvements to:

- Building energy management control system
- 12 rooftop air handling units with associated fans/controls
- Variable air volume (VAV) terminal boxes
- Pneumatic and fire alarm controls
- 2 hot water boilers
- 4 hot water circulation pumps
- 5 heat pumps
- 5 hydronic duct coils
- Heat recovery unit
- Air conditioning unit
- 9 exhaust fans
- 4 domestic hot water heaters and 4 circulation pumps

In Phase 2, the commissioning scope of work included:

- Review of mechanical design drawings
- Review of energy management control system submittals
- New VAV terminal boxes
- New fan coil units
- New air handling units
- New air conditioning for the graphics laboratory
- New point-of-use exhaust in science classrooms
- New sawdust collection system
- Increased outside air quantities
- New electric duct heating coils in the primary air handling system
- New local exhaust systems
- New direct digital control (DDC) system with graphical user interface
- Air and hydronic system testing and balancing



*During construction. A temporary seal is placed over the open end of ductwork to keep out dirt and dust.*

## ISSUES IDENTIFIED

During the construction and functional testing phases, the commissioning process identified and resolved 131 issues. Among the key findings were:

- Relief vent hood not attached on the roof.
- Air handler outside air dampers not closing properly.
- Return fan and supply fan status “on” when the units are off.
- Supply fan inlet vanes not responding properly to space conditions.
- Several VAV boxes were unable to supply required air volume during tests of full cooling.
- Several VAV boxes were not receiving enough primary air from the air handlers.
- Heating valve on a fan coil unit did not function properly.
- Exhaust fans controlled by temperature setpoint not responding when setpoint exceeded.
- Building automation system showing incorrect readings of system operations.
- Deficiencies in the DDC graphical user interface software. For example, graphics did not accurately depict equipment and/or systems being controlled.

## ENERGY IMPLICATIONS OF COMMISSIONING

Among the energy saving opportunities identified during commissioning were:

- Adopting a night setback mode for fan operation, with an early morning building purge.
- Integrated scheduling and operating Air Handling Unit #7 on full outside air.

## ADDITIONAL BENEFITS

Significant benefits relate to indoor air quality, liability avoidance, better quality construction, and a completely functional building.

The final commissioning report is a document that will aid maintenance staff in reproducing tests that were done during commissioning, helping to troubleshoot problems in the future.

Most importantly, the spaces within the school are consistently being ventilated and conditioned to provide a comfortable learning environment for students and staff.

## PROJECT BENEFITS

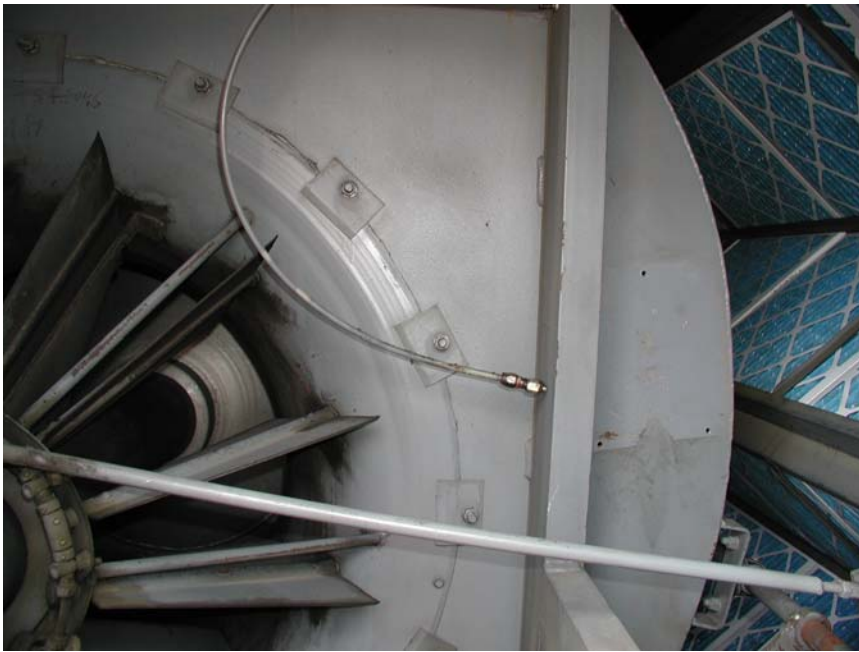
- \$31,600 in first-year cost benefits (such as reduced energy consumption, improved indoor air quality, fewer contractor call-backs, reduced change orders, problems corrected at design stage, etc.)
- \$24,300 in annual energy savings
- HVAC systems functioning correctly
- Improved indoor air quality
- Thermal comfort and occupant satisfaction
- Maintainability of HVAC system

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“...Important to go with commissioning, especially on a fast-track project. [Next time we would] not make any changes in our approach, but we would involve the commissioning agent at the beginning of the design, especially to make sure the boiler plate controls specifications are tailored for the facility.”

Dean Martinolich  
North Thurston Public Schools

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*Note that lubricant tubing is running too close to the inlet vanes of a fan.*

## WHAT IS COMMISSIONING?

Building commissioning is a systematic and documented process of ensuring that building systems perform according to the design intent and the owner's operational needs.

Commissioning is used in both new construction and existing buildings.

Commissioning:

- Provides a better environment for occupants
- Reduces indoor air quality problems
- Reduces occupant complaints
- Reduces contractor call-backs and warranty issues
- Reduces energy consumption and operational costs

## FOR INFORMATION ON WASHINGTON'S COMMISSIONING PROGRAM



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**BetterBricks**  
is an initiative of the



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